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Control of Static Electricity and Low Power Shocks

Three events involving static electricity or low-voltage power sources have occurred at LLNL and NTS since the beginning of 2006. Although in each instance the workers were not injured, these incidents highlight the importance of having the proper electrical ground on equipment.

Static electricity can cause startle shocks that may be painful but are normally not physiologically dangerous. The real hazard from a static shock is the body's inherent reaction to being startled, such as rapidly pulling a hand away and striking a fixed object or falling off a ladder. Static electricity can cause fires and explosions under the right conditions.

Even low-voltage power sources can cause incidents when not properly grounded. The following three events are related to improperly grounded equipment.

- A construction subcontractor electrician received a static electric shock while moving an aerial lift through double doors in the National Ignition Facility (NIF) Target Bay.
- A worker received a barely-perceptible shock when attaching a flexible metallic braid vacuum pump hose to the test port on a vacuum leak detector at JASPER at the NTS.
- A worker received a barely-perceptible shock, and saw a spark, when touching a control pendant for a lens trolley with his hand while touching the eyepiece on a high-speed camera with his eye at Site 300.

Analysis

- Static shock while operating lift The operator of the lift received the static shock when he touched a door while in contact with the lift's controls and guardrail. The build-up of a static charge from rubber-tired equipment rolling across the floor is a concern in NIF. As a precaution, ground straps are added to mobile equipment such as aerial lifts and industrial trucks prior to operation in the NIF to control this potential exposure. This static shock resulted from improperly maintained equipment; this lift had a rubber strap installed that was not a proper ground strap. A proper ground strap was installed, and the Daily Operator's Check List was updated to include checking the ground strap.
- Vacuum pump hose A vacuum pump hose was connected to a primary target chamber on a wheeled cart. Neither the chamber nor the cart was grounded. Both the primary target chamber and the cart are large metallic objects capable of storing significant electrical charge if isolated from ground. The likely cause of the incident was static build-up on the cart that resulted in a shock when discharged to the chamber. The problem disappeared when the cart was grounded.
- Control pendant and camera The camera housing was anodized aluminum that was grounded, however the anodized area near the eyepiece was worn through. The pendant was allowed to "float" with respect to building electrical ground. The metal faceplate on the 24-volt control pendant was not grounded. The camera and pendant system built up induced voltages during equipment operation as a result of several factors including moving film, high-speed rotors, and moving gases. The static or transient voltage shock resulted from ungrounded equipment. As a result all cameras and pendants in the facility were electrically grounded.

Recommended Actions for LLNL Employees

1. Recognize that equipment with moving parts or fluids operating in or around plastics, rubber, or synthetic materials can develop static charge potential and requires appropriate grounding to dissipate these charges. Grounding and bonding of the metal parts or enclosures will continuously discharge static. Rubber tires rolling across special floor coverings are ideal situations for static charge build up if proper grounding measures are not implemented.
2. Owners of electrical equipment should ensure that equipment is properly grounded and bonded to control the dissipation of static charges.
 - An electrically-qualified person should periodically check all equipment grounds to make certain that they are in place, in good condition, and provide a continuous path to ground.
 - Ground straps attached to mobile equipment and bonding within the equipment should be checked routinely.
 - Equipment operators should include an inspection of ground straps and bonding as part of their daily pre-operation checklist.
3. Workers should be aware of the condition of the equipment they use and operate. Any damage to equipment e.g., cords, plugs, receptacles, loose connections, excessive heat in cords or connectors, should be noted and reported to their supervisor for repair. This should include a consideration for normal wear of equipment — normal wear may not be considered “damage” but can easily result in conditions where the proper ground path is broken.
4. Additional requirements for the control of static electricity and equipment grounding are provided in Document 16.1 “Electrical Safety,” in the *ES&H Manual*, Sections 3.10 “Equipment Grounding,” and 3.11 “Static Electricity.”